



EUROPEAN SCHOOL OF ANTENNAS (ESoA)
NEW COURSE
DIAGNOSTIC AND THERAPEUTIC
APPLICATIONS OF ELECTROMAGNETICS
September 23-27, 2013, Torino, Italy



Course coordinators:
Prof. Ovidio M. Bucci, Università di Napoli Federico II
Prof. Giuseppe Vecchi, Politecnico di Torino and ISMB



Sponsorship:  Schmid & Partner Engineering AG

Course Motivation

Clinical and diagnostics applications of electromagnetic (EM) fields are rapidly increasing; research and technology development in this multi-cultural field extends beyond the well-known (and very important) issue of health protection from EM fields.

EM fields are already part of present-day clinical applications, although this is not widely known in the EM community. RF minimally-invasive surgery has drastically changed surgery rooms; Magnetic Resonance Imaging (MRI) stands as the most successful exploitation of EM interaction with biological systems, but a wide range of new applications are emerging in health care fields. They are as different as Microwave Imaging, EM Hyperthermia, monitoring of vital functions, remote localization and/or control of miniature implants or surgery equipments. Moreover, the advent of nanotechnologies, with the possibility to produce nanometer-size components able to efficiently interact with the EMF, while being biocompatible and linkable to a large number of macromolecular systems, can open completely new scenarios, including remote control of nanomachines and biological processes.

This evolution can disclose a wide range of new opportunities to Antenna and Electromagnetic engineers and researchers; research and professional work in this field requires meeting the challenges posed by well defined technical problems, as well as the ability of appreciating clinical needs and translating them into technical problems.

Course Aim

The Course aims at introducing this new and interdisciplinary area into the Antenna (and Electromagnetic) Community, giving the ability to understand the issues and challenges of medical applications of electromagnetic fields. It is primarily conceived for Doctoral students and researchers with an engineering or physics background.

After an introduction to Bioelectromagnetism, with particular attention to the safety aspects, the main current diagnostic and therapeutic applications of EM fields will be presented. The challenges posed by these applications to the electromagnetic engineer will be presented and discussed, emphasizing their multi-physics nature and the constraints which must be faced when dealing with medical applications. Selected emerging applications will be considered in more detail, and some foreseen developments will be presented. Guided numerical simulations and experimental demonstrations are planned as part of the course; numerical simulations will employ SEMCAD X software and the most advanced physiological models.

In this cross-disciplinary course, instructors will be from EM- and biomedical engineering, biology, and clinical fields. A special focus of this first edition will be on EMF for cancer treatment; **Prof. Paul Stauffer**, Director of Hyperthermia Physics Division, Radiation Oncology Dept., Duke University, USA will discuss clinical and system aspects of EM-based hyperthermia.



